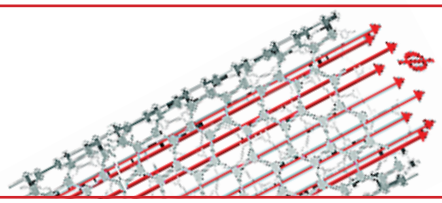
MPA material matters

July 2007



Newsletter of the Materials Physics and Applications Division

Bashyam receives publication prize for fuel cell research

MPA-11's Rajesh Bashyam is the 2007 recipient of the Postdoctoral Publication Prize in Experimental Science for his research publication "A class of non-precious metal composite catalysts for fuel cells," *Nature* **443**, 63 (2006). The article described the discovery of a new class of hydrogen fuel cell catalysts that exhibit promising activity and stability.

This biennial prize, sponsored by Damon Giovanielli and administered by the Laboratory's Postdoctoral Program Office, is awarded for the best article in experimental sciences, published or accepted for publication after January 1, 2004.

In the article Bashyam and his mentor MPA-11's Piotr Zelenay describe tests conducted on a cobalt-polypyrrole-carbon (Co-PPY-XC72) composite. The composite, consisting of cobalt, polymer and carbon, was developed in research aimed at developing low-cost non-platinum catalysts for the polymer electrolyte fuel cell (PEFC) cathode.

While the electrical energy producing activity of the catalyst is lower than that of platinum-based catalysts used in polymer electrolyte fuel cells, the new material shows exceptional performance stability for over one hundred hours of continuous testing, a result never before obtained with non-precious metal catalysts in PEFCs.

Bashyam's paper was selected by a panel of Laboratory technical staff members, and the research represents a seminal contribution to the field. He will receive a certificate, monetary award, and be given the opportunity to discuss his research at an upcoming Physics/Theoretical Division colloquium this fall.

Bashyam was nominated by Zelenay, with supporting letters from Director of Technology Transfer Division Duncan McBranch and from MPA-11 Group Leader Ken Stroh. The United States Department of Energy's Office of Hydrogen, Fuel Cells and Infrastructure Technologies funds much of the PEFC fuel cell research at Los Alamos.

Damon Giovanielli (left) congratulates MPA-11's Rajesh Bashyam on receiving the Postdoctoral Publication Prize in Experimental Science.

INSIDE this issue

Crooker awarded 2007 Fellows Prize for Research

NHMFL's Scott Crooker is the recipient of a 2007 Fellows Prize for Research in recognition of his outstanding research in the development of novel magneto-optical spectroscopies and their application to problems in solid state and atomic physics systems.

His work has resulted in the development of new tools and the discovery of new effects by combining advanced optical measurement methods with effects of magnetic fields and manipulation of spins in solids, thus leading toward new physics with potential applications in energy security and information processing technology.

The significance of Crooker's work has been recognized with highly cited articles published in *Nature*, *Science*, and *Physical Review Letters* as well as with invited and plenary talks at the American Physical Society's annual meetings, a 2006 Gordon Conference, and several

"Prize" continued on page 4

From John's desk

MPA: Moving forward on LDI survey results, meeting you, and PSM

I've just returned from a week at the "Happiest Place on Earth"—no, it's not my new office in the old Administration Building, but rather from a week of family vacation at Disney World. If you've not yet had a chance to enjoy some down time away from work this summer, I encourage you to do so in the surprisingly few days we have left.

I was pleased to see a number of you at our recent MST/MPA All Hands Meeting. We continue to experiment with the style and substance of these meetings. I'd very much welcome your feedback on what you found interesting and useful (and what wasn't).

In this forum, I want to let you know that we've taken the first steps to address the results of the Leadership Development Initiative (LDI) survey, especially in the area of reducing bureaucracy. Paul Follansbee and I have both tasked our respective group leaders to identify specific opportunities and issues from the list of concerns that they would be willing to personally champion. In addition, we have scheduled a briefing with Mike Mallory, our new PAD-Operations, and some of the LDI team members to discuss the details of the report. I'm confident that Mike will resonate with the concerns and act on them aggressively.

A number of you have asked recently about the merits of our move of the Division Office from the Materials Science Laboratory to the Ad Building, so I'd like to share my perspective (at least at the moment). On the positive side, there have already been a number of occasions in which a two minute hallway conversation with Susan Seestrom or other members of the ADEPS office has accelerated significantly progress on an MPA-centric issue that would previously have taken much longer to resolve. In addition, EPS division leaders have started having daily "end of the day stand-up meetings" in which we take 5-10 minutes at 5:30 each evening to ensure issues and opportunities are being communicated.

The potential downside of the move is being farther geographically from at least some of you and the barrier that a security fence provides, especially for e.g., foreign nationals. I think we're addressing this reasonably well at the moment—again, your feedback to the contrary is most welcomed, but there are two additional actions we will take. I continue to hold ~ 50% of my meetings in our former MSL offices (and you can still get on my calendar in the same way as always: call the Division Office at 5-1131).

What remains to be done is to post "office hours" when I will be in the MSL office. I won't promise to just sit there waiting for you to visit, but this will provide an opportunity to catch me briefly between and around other scheduled meetings. In addition, we will post in the MSL office, my schedule for being there—so that when you arrive for a scheduled meeting and the lights are off you'll have some confidence that I'll actually show up.

Lastly, I want to update you on several HR related issues. We are now entering the heart of performance and salary management (PSM) season. Hopefully, all of you are working on providing input to your group leaders on your performance relative to your IPOs in the last year. We have extended this year's performance period until September 30; so, if big changes occur, you can update your self assessment between now and then, but in most cases, what you write now should be a good approximation of an annual summary.

The process we will use to identify ORC scores and salary increases will be relatively similar to past years. While there are still discussions ongoing among myself and your group leaders, I think the set of peer groups we used last year were reasonably effective, and these will be the starting point for this year.

In addition, it's worth noting that the Laboratory wants to reward performance more aggressively, which likely translates into a wider distribution in the sizes of raises (at both the high and low end of ORC ranges). As more details emerge, we will keep you posted. In addition, the Compensation Design Project is embarked on mapping everyone into new job titles and families.

The goal of this effort is to promote fairness across local peer groups, enhance the opportunity for individuals to move across organizations in a common job structure, and to ensure that similar performers doing similar work are compensated similarly. In practice this means, for example, that job titles like "Tec6" will go away and will be replaced by a larger number of more meaningful job titles, e.g., Machinist 1 or Laser/ Optical Tech 2.

Again, our goal is to keep you informed and avoid confusion through what could be a stressful period. As always, your group leaders are good resources for further details and information.

—Materials Physics and Applications Division Leader John Sarrao

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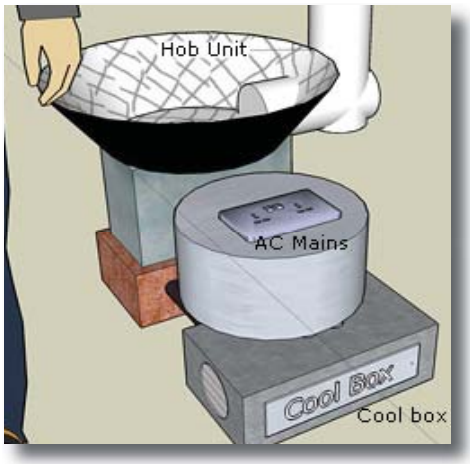
Thermoacoustically powered refrigerator to benefit residents of developing countries

Scott Backhaus, MPA-10, is part of an international collaboration developing a thermoacoustically driven refrigerator that can be used in rural areas where there are no sources of electrical power. The SCORE (Stove for Cooking, Refrigeration, and Electricity) device will burn wood to produce thermoacoustic energy that is used to provide refrigeration. The device will also provide heat for cooking as well as generate electricity.

Thermoacoustics takes advantage of the way that sound waves can be produced when a gas is heated unevenly. In a thermoacoustic engine, such as the Stirling engine developed in the nineteenth century as an alternative to steam power, these pressure sound waves drive mechanical motion. This process may also run in reverse: the sound waves can be used to extract heat, pumping it from a cool source to a hot sink and thereby inducing cooling. One of the main attractions of SCORE stoves is that they don't need an external electricity supply.



The biomass-powered SCORE is an all-in-one stove, electricity generator, and refrigerator.

Backhaus is working with a team led by researchers at the University of Nottingham in England. The project is funded by the Engineering and Physical Sciences Research Council, a United Kingdom governmental organization. The team plans to be producing the SCORE devices within five years.

Ultra-strong, lightweight carbon nanotube fiber winner of Nano50 award

The ultra-strong, stiff, and lightweight carbon nanotube fiber, a product developed by the MPA-STC carbon nanotube team and licensed by CNT Technologies, is a 2007 winner of a Nano50 award. The awards, given by the online magazine Nanotech Briefs, recognize the top 50 technologies, products, and innovators that have significantly impacted—or will impact—key nanotechnology commercial markets.

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Spun from carbon nanotubes—the strongest, stiffest material known—super CNT fibers have one-tenth the density and four to five times the specific strength of the best carbon fibers now used to make advanced structural composites. To achieve this superior performance CNT fibers are spun from ultralong (~1 mm) carbon nanotubes that have only two walls and a hollow center, giving them low density. The use of super CNT fibers will ultimately increase the fuel efficiency of commercial aircraft by reducing weight and increase the stealth of combat aircraft by reducing radar cross-section. The use of these fibers will also reduce space-launch costs by reducing the weight of rockets and spacecraft, and improve sports equipment performance by reducing weight and increasing strength and stiffness.

The award will be given in November at the Nano Engineering Conference in Boston.

The ultra-strong, stiff, and lightweight CNT fibers were also submitted as one of the Laboratory's entries in the 2007 R&D 100 Awards competition. Team members in the project included MPA-STC's Yuntian Zhu, Paul Arendt, Ray DePaula, Qingwen Li, Dean Peterson, Chris Sheehan, Xeifei Zhang, and Lianxi Zheng; and CNT Technologies' Robert O'Leary, Timothy Clapp, P. Douglas Kirven.

MPA @ SCES '07

MPA Division had a strong showing at the recent 2007 International Conference on Strongly Correlated Electron Systems in Houston. NHMFL's Neil Harrison presented an invited talk, "How do holes get heavy and superconduct?" in which he discussed doped Mott insulator physics in $CeIn_3$ and implications for pressure-induced superconductivity.

Presenting contributed talks were MPA-10's Nick Curro, who discussed his recent NMR work on the complex superconducting phase diagram in $CeCoIn_5$, MPA-10's Tuson Park, who discussed the coexistence of magnetism and superconductivity exhibited by $CeRhIn_5$ and NHMFL's John Singleton who presented work on Fermi-surface topology and field-dependent effective masses in the skuttuderite $PrOs_4As_{12}$. Also in attendance were several MPA staff presenting recent research during the poster sessions.

Heads UP, MPA!

Legacy contamination postings

You may have already noticed them. Bright yellow radiological controlled area (RCA) postings have gone up around MCFO facilities as well at other sites at the Laboratory.

Designed to notify personnel about legacy contamination, these postings are required by ISD 121-1, Radiation Protection, section 722. You may see them on fence lines at vehicle and personnel gates or on doors to buildings.

In and around MST and MPA sites, the signs are currently posted at the:

- TA-48 fence, encompassing every building inside the TA-48 fence
- TA-03-0066 (Sigma) fence, encompassing every building inside the fence
- TA-46 "fence line." (Although the fence line is incomplete, sign are posted where there is a clear road or walkway into TA-46. Building 535 is not posted.)
- TA-03-32/34, to be posted when signs are available.

Radiological Training

As with other RCAs, personnel entering these areas need to complete at a minimum GERT (General Employee Radiological Training). A two-year retraining is required.

You will receive an e-mail if you are not complete on at least GERT training and you access any of the facilities where GERT is required. The MCFO training team will proctor the GERT exam at the MCFO training office. Additionally, there are several other proctor sites available throughout the Laboratory (see below).

Appointments are required for a proctored exam. Note that radiological worker training satisfies the requirements of GERT.

If you have any questions, please call 5-9430.

On August 31 MC FOD will limit access to GERT employees.

- MCFO Training Office- TA-3-1415, Room 148, 5-9430
- White Rock Training Center – 7-0059
- TA-46 Chemistry Division Proctor: Pam Hundley –TA-46-535, 4-0261

Fixing your space

Since the FIN (Fix-It-Now) program was recently dissolved, MCFO facility services can be requested as expedited work.

The expedited work process is similar to the FIN process, but it utilizes the resident KSL crafts to perform low complexity, non-emergency, low hazard maintenance and service activities.

Tenants should continue to submit requests through the service request system, http://www.mst.lanl.gov/cgi-bin/serviceRequest/frmEntry.pl.

Before lightening strikes

The summer monsoons are underway and along with refreshing rainfall and cooler temperatures comes the threat of dangerous lightening.

A new *Safety Short*, "Before Lightning Strikes," delivers lightening facts and ways to protect yourself and includes a three-minute video, flier, poster, and toolkit for safety meetings.

For more details see http://int.lanl.gov/safety//.

Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.

"Prize" *Continued from page 1*

national and international conferences and seminars.

Crooker earned his Phd in physics from the University of California, Santa Barbara, where he used ultrafast lasers to study spin dynamics in diluted magnetic semiconductors. In 1998 he became a Director's Postdoctoral Fellow at the NHMFL and has been on the scientific staff at the magnet lab since 2000. His interests include magneto-optical imaging of spin-polarized electron transport in semiconductor "spintronic" devices, spin fluctuations in atomic and solid-state systems, and low-temperature optical spectroscopy of quantum dots, nanotubes, and semiconductor quantum wells in pulsed magnetic fields to 90 tesla.

The Fellows' Prize for Research honors individuals for outstanding research performed at the Lab, published within the past 10 years, and exerting a significant disciplinary or programmatic impact. The Fellows prize is open to all full-time staff members; however, fellows and postdoctoral researchers are ineligible for consideration. Laboratory employees nominate staff members for the Fellows' Prize. A committee of Laboratory Fellows reviews the nominations and recommends its selection to the Director.

Celebrating service

Congratulations to MPA employees celebrating recent service anniversaries:
15 years: John Kennison, MPA-STC
10 years: Fedor Balakirev, MPA-NHMFL
10 years: Michael Gordon, MPA-NHMFL
10 years: Jonathan Betts, MPA-NHMFL

Green Chemistry cover features MPA-MC method of producing high-quality ionic liquids

Ionic liquids are employed in many areas of chemistry and materials—being a unique solvent for many synthetic and catalytic applications.

In particular the highest purity materials are desirable and necessary in spectroscopy, electrochemistry, catalysis, electron transfer and biology.

Yet there are inherent issues which arise if the utmost care is not taken in the preparation and purification of these materials. Spectroscopic-grade ionic liquids are not easily synthesized and purified using commonly used methods.

In a May *Green Chemistry* cover article, researchers in MPA-MC and Oak Ridge National Laboratory describe a reliable method for producing large quantities of high-quality, spectroscopic-grade ionic liquids.

Additionally, they show that most classes of ionic liquids do exhibit fluorescent backgrounds when extreme care is not taken during their synthesis and purification, that the fluorescence is not due to their "inherently fluorescent" nature, and that spectroscopically clean ionic liquids are attainable in large quantities.

The work by MPA-MC's Anthony Burrell, Rico Del Sesto and Mark McCleskey and ORNL's Sheila Baker and Gary Baker appears in *Green Chemistry*, **9**, 449 (2007).

The Los Alamos portion of work in "The large scale synthesis of pure imidazolium and pyrrolidinium ionic liquids" was supported by the Department of Energy Buildings Technology Program and the LANL Director's Fellowship.

Zapf presents lecture on magnet technology, its challenges and applications at Bradbury Museum

"Large Magnets and New Science" was the focus of a talk by MPA-NHMFL Staff Member Vivien Zapf recently at the Bradbury Science Museum in Los Alamos.

The lecture was part of the Los Alamos Women in Science Seminar Series and was co-sponsored by the Bradbury Science Museum and the Los Alamos National Laboratory Community Programs Office.

Zapf, who studies the fundamental properties of materials at high magnetic fields and low temperatures including quantum magnets, superconductors and other correlated-electron systems, was also interviewed on local radio station KRSN Tuesday in advance of her talk.

At the National High Magnetic Field Laboratory Zapf has access to the most powerful magnets in the world. Los Alamos' Pulsed Field Facility recently set a new record for the largest non-destructive pulsed-field magnet. In her talk Zapf presented the current state of magnet technology and the challenges that come with it. She also discussed the research done at the facility and the new fundamental states of matter that develop at high fields as well as the broad applications of magnet technology in daily life.

Zapf, who received her PhD at the University of California at San Diego in 2003, was a Milliken Postdoctoral Fellow at Caltech and a Director's Funded Postdoctoral Fellow at Los Alamos before becoming a Los Alamos technical staff member.

Got news? Have technical highlights you'd like to see featured in *MPA Material Matters*? Send to your group leader to be forwarded to Editor Karen Kippen.

Laboratory's materials capability focus of tag team MPA/MST all-employee meeting

Members of the 2006-2007 Leadership Development Initiative include (above from left) Amit Misra, Jennifer Martinez, Heather Hawkins, Marcelo Jaime, Jason Cooley, and Terry Holesinger. Not pictured: Mike Rivera, Mark McCleskey, Stuart Maloy, and Kimberly DeFriend. At left, Holesinger receives his graduation certificate from Division Leaders John Sarrao and Paul Follansbee.

MPA and MST Division Leaders John Sarrao and Paul Follansbee held a joint all-employee meeting last month at the one-year anniversary of the transition and creation of the organizations.

With the Division Leaders alternating in presenting topics, the meeting featured an overview of the PRIME (Predictive Responsive Infrastructure for Materials Exploitation) signature facility proposal put forward by Sarrao and Follansbee, a briefing on the recent Materials Capability Review, Division updates, a discussion of the MST/MPA Leadership Development Initiative's Science and Technology Productivity Metrics report, and the graduation of the 2006-2007 LDI class.

PRIME is designed to be the materials laboratory for national security through predictive science supported by fundamental experiments. Sarrao described the Laboratory's selection of PRIME as its primary planning scenario "a strong validation for the materials community in that when the Laboratory thinks about what its future is going to look like, it is a vision that is so materials-centric."

In paraphrasing the Materials Capability Review Committee oral outbrief Follansbee said the committee members "saw lots of evidence of outstanding science and applied technology and they got the message that 'materials at Los Alamos is huge.' "

Before graduating members of the LDI class Sarrao and Follansbee presented the results of the group's survey of science and technology productivity metrics, designed to assess the reorganization of the division in relation to intellectual atmosphere, research capabilities, and business practices. The presentation also included the group's recommendations and future actions on these suggestions.

A summary of the LDI report as well as a video and the slides of the all-employee meeting can be found on the MPA home page at http://int.lanl.gov/orgs/mpa/index.shtml.

Successful summer lecture series informs students of Laboratory's opportunities

The Summer Lecture Series, organized by MPA Division, the Los Alamos National Laboratory institutes, and the LANL Student Association was a rousing success, drawing nearly 1,000 participants to the 20 talks held during the month of June. The series will continue next year.

Open to all Los Alamos badge holders, the series was specifically designed to allow new students, postdoctoral researchers, and staff meet the best and brightest among Los Alamos scientists. In the course of talks and site visits participants had the opportunity to see the facilities and learn about Los Alamos at the beginning of their summertime work at the Laboratory.

Scientists from across the Laboratory presented talks on topics which ranged from clean energy solutions of the future, plutonium science, biotechnology and biology-inspired materials science, the foundation and future of materials research at Los Alamos, and high magnetic field studies. Participants were given tours of the Center for Integrated Nanotechnologies, the National High Magnetic Field Laboratory, and the Los Alamos Neutron Science Center.